Post-breeding dispersal of Guillemots *Uria aalge* in the North Sea, late summer 1993

Dispersie van de Zeekoet na de broedtijd in de Noordzee, nazomer 1993

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Introduction

Most North Sea Guillemots breed on cliffs in northeast Scotland and on Shetland and Orkney. Breeding commences early May, and chicks hatch in about one month time. Some 20 days after hatching, late June or early July, the flightless chicks leave the colony by jumping off the ledges and swim away from the coast, accompanied by one of their parents, usually the male (Harris & Birkhead 1985). The male will feed the young at sea for another 2-3 months (Harris *et al.* 1991). During the post-breeding dispersal, the adults become flightless as a result of primary moult (all primaries are shed simultaneously). Tasker *et al.* (1986) suggested that the direction of movements away from the coast depends on the distribution of small fish, especially sandeels Ammodytidae.

Seabirds at sea in the North Sea have been counted during ship-based surveys since the late 1970s. Between late June and early September 1993, observers were able to join RV *Tridens* and MV *Mercuur* and seabirds were counted in two periods: at the end of the breeding season (June/July) and shortly thereafter, in August/September. Guillemots *Uria aalge* were among the most numerous and widespread seabirds in both periods and dispersal patterns of Guillemots were analysed and compared with those found in previous years.

Methods

The data were collected during three trips on the North Sea. The first surveys were onboard RV *Tridens*, between 29 June and 15 July during an echo-location survey for Herring *Clupea harengus*, and were mainly restricted to the northwestern North Sea (figure 1). Seabirds were counted in strip-transects in 10-minute intervals, according to methods described by Tasker *et al.* (1984), over a total distance of 2967 km, covering a surface area of 883 km². The second trip was on 14 August only, onboard MV *Mercuur* on a birding trip to the Frisian Front in the southern North Sea (see Leopold 1993). Between 16 August and 3 September seabirds were counted, again onboard RV *Tridens*, during the International Bottom Trawl Survey (IBTS; figure 2). The surveys in August and early September comprised counts over 2323 km distance, covering 680 km² with strip-transects.

From counts of seabirds within a 300 m wide transect aside of the ship, densities of birds (number of birds per km² surveyed) were calculated. Unlike most previous studies, these densities were not summarised in grid squares, but exact positions of observed densities were plotted on a map using the mid-position of each count (*i.e.* a ten-minute period) in order to reveal dispersal patterns as movements away from the coast. All Guillemots in transect were used to calculate densities, whereas the presence of adult/chick couples in each ten-minute count was assessed separately.

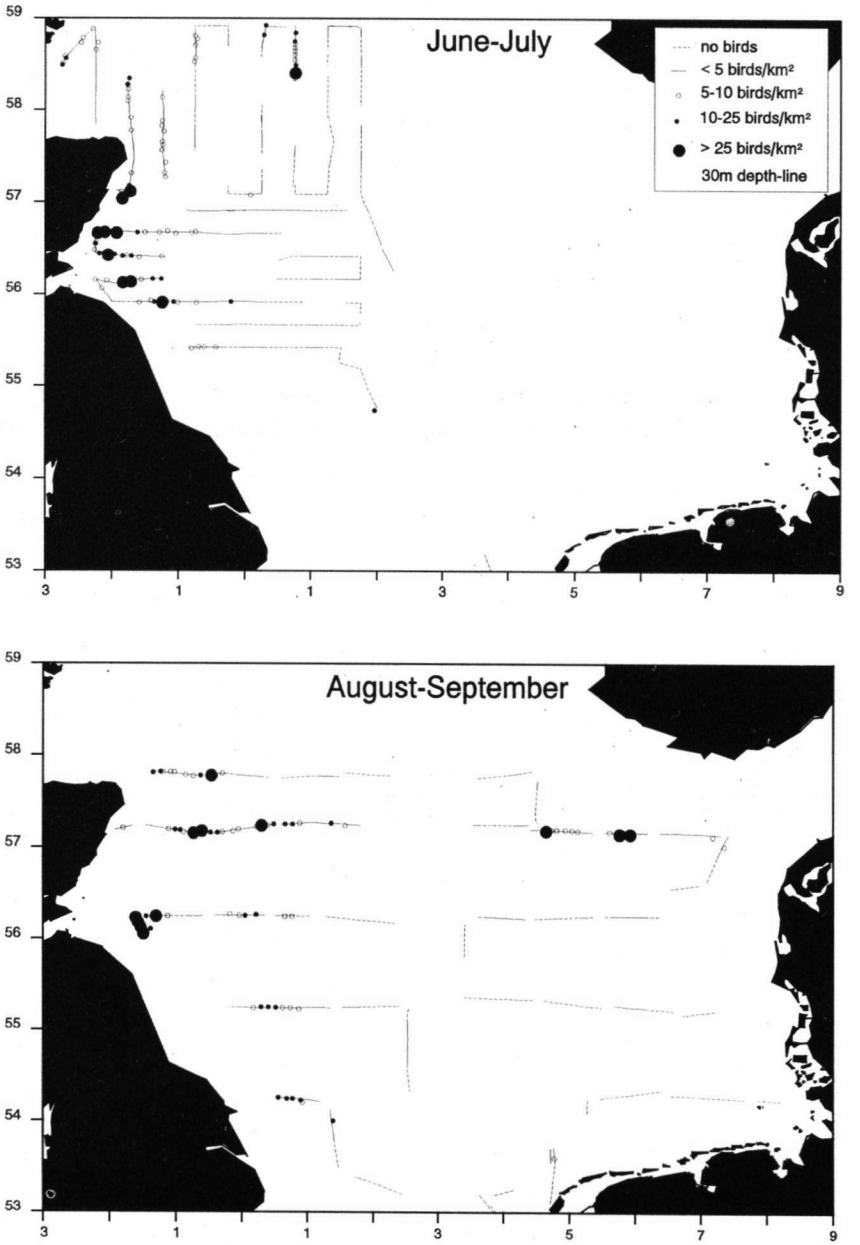
In search of evidence to support the suggestion that during post-breeding dispersal auks concentrate in areas rich in small fish, the data were compared with information on the abundance of fish derived from the echo-location survey in June/July (Corten 1993 and pers. comm.) and from catches during the IBTS (A. Rijnsdorp and G. van der Kamp pers. comm., own observations). Because the IBTS catches are rather poor indicators of the availability of

Figure 1. Distribution of Guillemots Uria aalge *in the northwestern North Sea in June/July 1993. Shown are the route (solid and dotted lines) and areas with moderate to high densities (dots).*

Figuur 1. Verspreiding van Zeekoeten in de noordwestelijke Noordzee in juni/juli 1993. Weergegeven zijn de route (doorgetrokken en onderbroken lijnen) en de gebieden met matige tot hoge dichtheden (stippen).

Figure 2. Distribution of Guillemots in the North Sea in Augustus/September 1993. Shown are the route (solid and dotted lines) and areas with moderate to high densities (dots).

Figuur 2. Verspreiding van Zeekoeten in de Noordzee in augustus/september 1993. Weergegeven zijn de route (doorgetrokken en onderbroken lijnen) en de gebieden met matige tot hoge dichtheden (stippen).


June-July
no birds
< 5 birds/km²
5-10 birds/km²
10-25 birds/km²
> 25 birds/km²
30m depth-line
59
58
57
56
55
54
53
3
1
1
3
5
7
9
August-September
59
58
57
56
55
54
53
3
1
1
3
5
7
9

small fish for seabirds, the relative abundance of cetaceans during these surveys was assessed, to serve as another indication of the quality of different areas for feeding (*cf.* Evans 1982, Burger 1988).

Results

In June/July high densities of Guillemots were almost exclusively found near the coast, or rather, near colonies (figure 1). One cluster of high densities at 58°20'N and 0°45'E, some 175 km NE off the nearest coast (Peterhead, NE Scotland) is remarkable. The cluster comprised several hundreds of Guillemots on 3 July 1993. Most of these birds were in breeding plumage (84%), while about 4% were chicks. This was the first group of Guillemots with chicks found well offshore and these may have represented one of the first cohorts of fledglings which had left the cliffs. Low densities occurred in most of the northwestern North Sea, and Guillemots were virtually absent in the central North Sea and near the Dogger Bank.

In August/September the pattern had changed (figure 2). High densities of Guillemots were found at various locations offshore. Clusters of high densities occurred off SW Norway (Skagerrak entrances), off NE Scotland and off Firth of Forth. Moderate densities occurred mainly in the western half of the North Sea, off Scotland and England and at the Frisian Front. Low densities were found throughout the North Sea, but Guillemots were very scarce in the German Bight. Most striking on these surveys, which comprised long stretches of continuous steaming towards or away from the coast, was a pattern of regular peaks and lows in densities of Guillemots: clusters of moderate to high densities were found in a wavelike pattern away from the coast, at regular distances, all across the North Sea. Couples of adults and chicks were found in all areas with high densities ($> 5/km^2$). In June/July, most chicks still occurred near the coast of Scotland. In August/September adult/chick couples were totally absent south of 56°, east of 3°E, except at the Frisian Front (Leopold 1993).

Discussion

Unfortunately, the datasets collected in June/July and August/September were rather different: surveys were restricted to the northwestern North Sea in June/July and were often near the coast, whereas the ship stayed well offshore in August/September and visited a much larger area. However, compared to surveys in previous years, distribution patterns of Guillemots were

roughly as expected (*cf.* Tasker *et al.* 1985, 1986, 1987) and Guillemots accompanying chicks were probably still very rare or even absent in the eastern and southern North Sea in early July.

Obviously, in June/July (the end of the breeding season) most Guillemots were still associated with breeding colonies (figure 1; *cf.* Lloyd *et al.* 1991 for breeding distribution of Guillemots). However, the presence of juveniles at sea indicated that some birds had left the colonies. The offshore cluster with high densities of Guillemots mentioned earlier (58°20'N, 0°45'E) was found in an area which was particularly rich in Herring in that period (echo-location survey results; Corten 1993) and this could support suggestions that Guillemots concentrate in important feeding areas. However, slightly further to the south, Herring stocks were even richer, while Guillemots were scarce or absent. Generally, Guillemot distribution at sea in June/July could not be explained by the relative abundance of Herring and Sprat *Sprattus sprattus* as found during the echo-location survey (Corten 1993 and pers. comm.).

Dolphins (*Lagenorhynchus albirostris*, *L. acutus* and *Delphinus delphis*), Harbour Porpoises *Phocoena phocoena* and Minke Whales *Balaenoptera acutorostrata* occurred throughout the study area, with comparatively frequent sightings off Peterhead (NE Scotland) and offshore. Clusters of sightings of cetaceans did not match the distribution pattern of the auks. So, if cetaceans are acceptable indicators of rich feeding areas, the distribution of Guillemots at sea could not be explained the same way in June/July.

In August/September, high densities of Guillemots were found further offshore. Clusters of high densities were found as far away from colonies as in the Skagerrak entrances (57°N, 4-6°E), similar to findings that time of year in previous years (Tasker *et al.* 1987 and European Seabirds At Sea Database, unpubl. data). Also the presence of Guillemots and chicks at the Frisian Front was reported earlier for July and August (Leopold 1988, 1991). Most striking in the distribution of Guillemots in August/September was the wavelike pattern. This pattern occurred all the way across the North Sea, towards the Skagerrak. Unfortunately, adequate information on the distribution of (small) fish is not available. High densities of Guillemots did occasionally coincide with good catches of young Herring and Sprat, but were just as often in areas in which catches were not particularly large. Cetaceans occurred scattered over most of the western half of the North Sea, but areas with high densities of Guillemots were not necessarily identified as areas with frequent sightings of marine mammals and *vice versa*. Exceptions were waters off Wee Bankie, where Guillemots were abundant in an area with feeding Minke Whales, at the same latitude 1-2° further to the east where White-beaked

Dolphins occurred in areas rich in auks, and just NW of the Dogger Bank, where moderate to high densities of Guillemots occurred in the same area as several groups of White-beaked Dolphins and some Minke Whales. In the north and further offshore in the central North Sea, distribution patterns of Guillemots and cetaceans did not overlap.

The pattern of clusters of high densities of Guillemots appears to be too regular to be attributed to the distribution of fish *c.q.* rich feeding areas. Instead, each cluster could represent a cohort of Guillemots which fledged during the same night (or series of nights with a high fledging rate). The distance between two clusters is approximately 65 km and assuming that two neighbouring clusters represented two cohorts of consecutive nights, and that these cohorts moved in the same direction, the displacement of Guillemots can be estimated at *ca.* 3 km/h in an easterly direction. The main current at 57°N off the Scottish coast is eastward and leads towards the Skagerrak (Lee 1980). Although this current is rather weak (*ca.* 2 km/h), it would assist the birds significantly while paddling across the North Sea.

The conclusion which can be drawn is that the post-breeding dispersal pattern of Guillemots did not represent good feeding areas, as suggested by Tasker *et al.* (1986). We suggest that the wavelike dispersal pattern, with regular patches of Guillemots represented different cohorts on their way east or southeast, particularly towards the Skagerrak. Obviously, since the chick needs to be fed during the movements away from the colonies, rich feeding areas will attract Guillemots while they move towards the wintering grounds at least temporarily. These and other surveys indicate, however, that many Guillemots rapidly moved in an easterly direction. The cohorts of auks found at sea could develop near the colonies (jumping cohorts), or in rich feeding areas near the coast in which Guillemots temporarily concentrated. These areas would enable the birds to store sufficient energy reserves needed for long distance movements.

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Samenvatting

Tijdens de 'haringecho survey' en de 'International Bottom Trawl Survey' van het visserijonderzoeksschip Tridens werden respectievelijk in juni/juli en augustus/september 1993 vogels geteld in grote delen van de Noordzee (figuren 1 en 2). Daarnaast werden gegevens verzameld aan boord van MS Mercuur op een tripje van Den Helder naar het Friese Front in augustus. De gegevens werden geanalyseerd om na te gaan hoe de dispersie van Zeekoeten verliep na het broedseizoen. In juni/juli bleken de vogels hoofdzakelijk in de buurt van de kolonies voor te komen, terwijl op 3 juli, op ongeveer 175 km ten noordoosten van de dichtstbijzijnde kust (Peterhead, NE Schotland), een concentratie vogels werd gevonden waarvan 4% bestond uit pas 'uitgesprongen' kuikens. In augustus/september werden Zeekoeten wijd verspreid aangetroffen, met locaal hoge dichtheden tot het Skagerrak aan toe. De gebieden met hoge dichtheden (figuur 2) geven op de kaart een regelmatig golfpatroon afgewisseld met gebieden lage dichtheden te zien. De verklaring wordt gezocht in het voorkomen van clusters van ongeveer tegelijkertijd van de rotsen gesprongen vogels, op weg in oostelijke richting naar hun overwinteringsgebieden. Slechts enkele concentratiegebieden konden worden verklaard door een rijk voedselaanbod.

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